

DETAILED ACTION

Claim Objections

1. Claim 76 is objected to because of the following informalities: the third line of the claim recites a concrete matrix in which a said rod is embedded. Appropriate correction is required.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.
3. Claims 1 and 4-6 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.
4. Regarding claim 1, the word "functionally" renders the claim indefinite. It is unclear to examiner what this term is defining with respect to the claimed rod. Further, the instant specification seems to merely repeat the term without further explaining what is encompassed by the phrase "functionally discontinuous".
5. Regarding claims 4 and 5, the phrases "such as" and "like" render the claims indefinite because it is unclear whether the limitations following the phrase are part of the claimed invention. See MPEP § 2173.05(d).

6. Claim 5 recites the limitation "said resin". There is insufficient antecedent basis for this limitation in the claim. Examiner notes that claim 5 depends from claim 4 which depends from claim 3. It is further noted that claim 3 does not recite "resin" but does recite polymeric matrix.
7. Claim 6 recites the limitation "said outer layers". There is insufficient antecedent basis for this limitation in the claim because claims 1 and 3 do not recite "outer layers". In fact, the claims only refer to an over-wrap of a second material.
8. Claim 75 recites the limitation "functionally discrete". It is unclear to examiner what this phrase is defining with respect to the claimed method. Further, the instant specification seems to merely repeat the term without further explaining what is encompassed by the phrase.
9. Claim 83 is recites the limitation "polyaramide Kevlar outer wrap". The claim scope is uncertain since the trademark or trade name cannot be used properly to identify any particular material or product. Ex parte Simpson, 218 USPQ 1020 (Bd. App. 1982) MPEP 2173.

Claim Rejections - 35 USC § 102

10. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

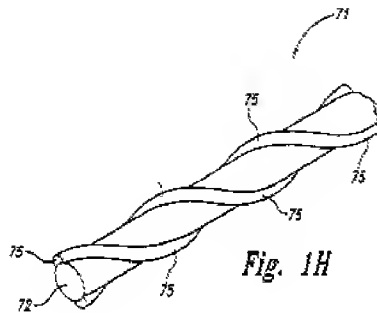
A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

11. Claims 1-7, 9, 10, 22, 24, 38, 39, 56, 57, 74, 76, 82 are rejected under 35 U.S.C. 102(b) as being anticipated by Edwards et al. (US 2001/0023568)

Regarding claims 1, 38, 56 Edwards et al. discloses reinforcing bars for concrete structures. (See Abstract) Edwards et al. discloses the reinforcing bar (rebar) comprises a composite of a plurality of longitudinally oriented reinforcing fibers embedded in a matrix of a thermoplastic resin. (See [0013]) Edwards et al. discloses rebar 71 has spiraled windings 75, which may be overmolded or pultruded onto the main body 72 or rebar 71. (See [0045]) Examiner notes that the claim limitations do not require that the first material and the second material be different. Further, as shown below, the spiral windings provide an over-wrap material which is structurally discontinuous relative to the inner rod. Therefore, Edwards et al. discloses a rebar meeting the limitations as claimed by applicant.

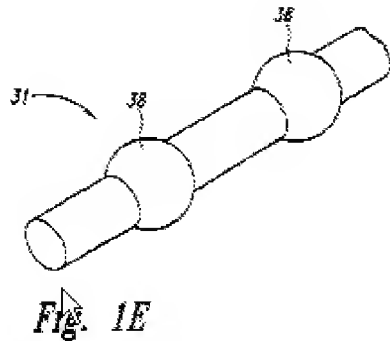
Art Unit: 1786



Regarding claim 2, Edwards et al. discloses the reinforcing bar (rebar) comprises a composite of a plurality of longitudinally oriented reinforcing fibers embedded in a matrix of a thermoplastic resin. (See [0013]) Edwards discloses the fiber-reinforced composite is formed into a rebar. (See [0033])

Regarding claims 3-5 and 24, Edwards et al. discloses in a preferred embodiment, both the main body 72 and windings 75 are pultruded composites of a thermoplastic resin and longitudinal reinforcing fibers. (See [0045]) Edwards et al. discloses the reinforcing fiber can be any strong, stiff fiber such as glass, other ceramics, or carbon. (See [0018]) Edwards et al. discloses the thermoplastic resin can be polypropylene. (See [0023])

Regarding claims 6, 7 and 10, examiner notes that applicant defines the zones of weakness by short spaced apart lengths of said inner rod having no outer-wrap over same. (See Claim 10) Edwards et al. discloses providing areas of increased cross-section by overmolding with a resin onto the bar. (See [0043] and Figure 1E)



Therefore, the zones of weakness as claimed by applicant are anticipated by Edwards. Further, Edwards discloses wrapping windings 75 about the main body 72 of the rebar. (See [0045]) Therefore, the windings 75 as shown above would also provide zones of weakness having no over-wrap over the inner rod. Finally, as shown by Figures 1H and 1E, Edwards et al. anticipates an over-wrap having zones of low frictional shear stress between the over-wrap and the inner rod interspersed among high frictional shear stress zones.

Regarding claim 9, examiner notes that applicant is claiming a process for providing the zones of weakness. Outside a showing to the contrary, it is the examiner's position that the method as claimed by applicant does not produce a materially different product than that of the prior art. Support for this conclusion is found in the instant specification where applicant discloses the over-wrap is removed for instance by mechanical cutting (or simply by not having been applied) at spaced apart locations. (See [0079]) As such, examiner notes that the rebar can still be produced without hindrance in final properties by simply not applying an over-wrap to desired spaced apart locations. The claim limitations are therefore anticipated by Edwards.

Regarding claim 22, examiner notes that while applicant is claiming a method of inducing pseudo-ductility or toughness in a fiber reinforced composite rod, the claim requires the same structure as that recited for claims 1-3. Therefore, examiner notes that Edwards et al. discloses a rod comprising a solid core and a fiber reinforced polymeric resin over-wrap on said core wherein said over-wrap is interrupted at spaced part locations as set forth above. Therefore, the method as claimed by applicant is also anticipated.

Regarding claims 39 and 57, Edwards et al. also discloses a rebar having a core 203 and sheathing 202. (See [0047]) Edwards et al. discloses the rebar may be adapted for use as a dowel bar wherein the bar does not mechanically interlock with the concrete. Therefore, it is preferred to apply a coating that does not adhere well to concrete. (See [0056])

Regarding claim 74 Edwards discloses a rebar having a circular, elliptical, oval, and square cross-section. (See [0035] and Figures 1H and 1E)

Regarding claims 76 and 82, Edwards et al. discloses offset portions 47 of rebar 41 create mechanical interlocking with the concrete. (See [0044] and Figure 1D) Edwards et al. discloses another way to provide mechanical interlocking is to provide raised surface dimples. As shown, rebar 86 has a plurality of dimples 89 that protrude from the main surface. A simple way is to partially embed a suitable particulate into the surface while

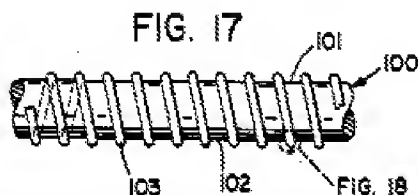
Art Unit: 1786

the thermoplastic resin is in a softened state. (See [0046]) As such, examiner notes that the outer surface would be textured.

12. Claims 1-10, 22-24, 27, 38, 39, 56, 57, 74, 76, and 83 are rejected under 35

U.S.C. 102(b) as being anticipated by Moghe et al. (US 5,080,547)

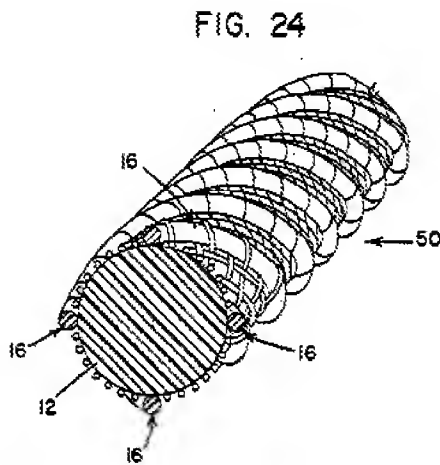
Regarding claims 1, 38, 39, 56, and 57 Moghe et al. discloses an elongated externally threaded member. (See Col 3, lines 9-10) Moghe et al. discloses the core is a rod and may be solid. (See Col 13, lines 18-21) Moghe et al. discloses the core may include one or more layers of braided, including triaxially braided, or knit fabric or at least two layers of opposite sense helical fibrous reinforcements to render the core resistant to torsional loading and/or fibrous reinforcements which extend in lengthwise, that is, the axial direction of the core. (See Col 13, 35-40) As such, examiner notes that Moghe et al. discloses a rod comprising an inner rod of a first material, and an over-wrap of a second material which is structurally discontinuous relative to the inner rod. Finally, examiner notes that while Moghe et al. is not explicit to using the rod to reinforce concrete, there is no showing of record that the rod of Moghe could not function in the same capacity.



Art Unit: 1786

Regarding claim 2, Moghe et al. discloses the core is preferably formed of a matrix which is reinforced with continuous fibers which extend in the axial, that is, the lengthwise direction of the core. (See Col 13, lines 32-35)

Regarding claims 3, 23, and 24 Moghe et al. discloses a rod as set forth in the figure below.



Examiner notes that in Figure 24 of Moghe, the structurally discontinuous over-wrap as claimed by applicant is provided by the thread-defining element 16. Moghe discloses that element 16 may be formed of twisted or tightly compacted fibers and/or pre-impregnating the sub-elements with polymeric or other matrix to form a solid circular bundle. (See Col 14, lines 6-14)

Regarding claim 4, Moghe discloses thread-defining element 16 may be formed of any suitable fiber and may include glass, carbon, and ceramic. (See Col 13, lines 48-53)

Art Unit: 1786

Regarding claim 5, Moghe et al. discloses the thread-defining element may comprise a polymeric or other matrix. (See Col 14, lines 10-15) Moghe et al. discloses suitable matrices include polyesters, , polyolefins, nylons, and epoxies. (See Col 7, lines 24-27)

Regarding claims 7 and 8, examiner notes that the low friction material on the inner rod as claimed by applicant would be equivalent to the braid layer and the over-wrap as claimed by applicant would be equivalent to the thread-defining element 16 which covers the braid layer.

Regarding claims 6 and 10, examiner notes that Fig. 17 above of Moghe shows short spaced apart lengths of the inner rod having no outer-wrap over the same. Further, it can also be seen in Fig. 24 that there are short spaces of the rod which are not covered by the braid layer or the thread-defining element. The zones of weakness are therefore anticipated by the prior art.

Regarding claim 9, examiner notes that applicant is claiming a process for providing the zones of weakness. Outside a showing to the contrary, it is the examiner's position that the method as claimed by applicant does not produce a materially different product than that of the prior art. Support for this conclusion is found in the instant specification where applicant discloses the over-wrap is removed for instance by mechanical cutting (or simply by not having been applied) at spaced apart locations. (See [0079]) As such, examiner notes that the rebar can still be produced without hindrance in final properties

Art Unit: 1786

by simply not applying an over-wrap to desired spaced apart locations. The claim limitations are therefore anticipated by Moghe as set forth above.

Regarding claim 22, examiner notes that while applicant is claiming a method of inducing pseudo-ductility or toughness in a fiber reinforced composite rod, the claim requires the same structure as that recited for claims 1-3. Therefore, examiner notes that Moghe discloses a rod comprising a solid core and a fiber reinforced polymeric resin over-wrap on said core wherein said over-wrap is interrupted at spaced part locations as set forth above. Therefore, the method as claimed by applicant is also anticipated.

Regarding claim 27, Moghe et al. discloses a particularly suitable core for externally threaded members where high modulus and strength and temperature resistance are desired is a rod formed of continuous carbon filaments bonded in a carbon matrix. (See Col 19, lines 5-8) Moghe et al. discloses one or more braided carbon fiber layers may be formed on the rigid rod. (See Co 19, lines 13-14) Moghe et al. discloses after formation of the braided or other reinforcing fabric layer(s) of the threaded member being manufactured, the assembly is preferably consolidated with the core by vacuum bagging followed by application of pressure and heat such as in an autoclave. (See Col 19, lines 22-26) Referring particularly to Fig. 24, examiner notes that the process of Moghe et al. provides a rod having the structure as claimed by applicant since the core is first reinforced with a braid which leaves open spaces for the thread-defining element to be

Art Unit: 1786

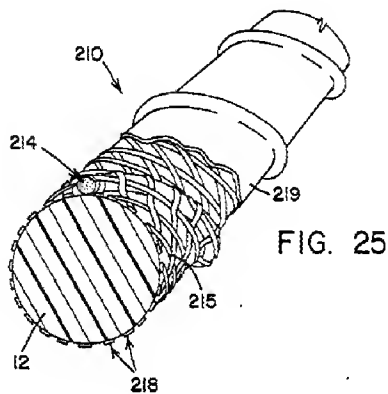
wrapped over the braid and core. Therefore, examiner notes that the braid would structurally separate zones of the thread-defining element bonded to the core.

Regarding claim 74, Moghe et al. discloses the core may have a cylindrical cross-section although other cross-sectional configurations may be such as hexagonal and those polygons having a greater number of sides or oval. (See all Figures and Col 13, lines 18-21)

Regarding claims 76 and 83, Moghe et al. discloses the core may include one or more layers of braided, including triaxially braided, or knit fabric or at least two layers of opposite sense helical fibrous reinforcements to render the core resistant to torsional loading and/or fibrous reinforcements which extend in lengthwise, that is, the axial direction of the core. (See Col 13, lines 35-40) As such, examiner notes that the outer reinforcements of the core as disclosed in Moghe et al. would provide a textured surface. Outside a showing to the contrary, it is the examiner's position that the rod as disclosed by Moghe would be fully capable of mechanically gripping a concrete matrix in which the rod is embedded since Moghe discloses a structure comprising like materials to that claimed by applicant. Further, Moghe discloses the fabric layer may be formed of any suitable high modulus fibers such as aramid and the like. Therefore, it would have been well within the ordinary skill in the art to utilize a polyaramide Kevlar outer wrap as claimed by applicant motivated by the desire to increase the deformation resistance of the rod. (See Col 8, lines 9-14)

Art Unit: 1786

Regarding claim 78, Moghe discloses a textured surface wherein a sheet material is provided over said entire outer surface. (See Fig. 25) One of ordinary skill in the art would expect that the sheath as disclosed by Moghe would be selectively removable since it is not required that the rod comprise a sheath thereon. (See Col 15, lines 34-42, wherein consolidation does not include a sheath)



13. Claims 1, 38, 39, 56, 57, 74, and 78 are rejected under 35 U.S.C. 102(b) as being anticipated by Mazzo et al. (US 6,527,481)

Regarding claims 1, 38, and 56 Mazzo et al. discloses a caisson having an inner, metallic core and an outer portion surrounding the inner core. Both the inner core and the outer portion are cylindrical. Metallic straps or bands can be disposed peripherally, in spaced apart relation, around the inner core for anchoring it to the outer portion of the caisson. The inner, metallic core is usually steel and the outer portion is concrete or grout. (See Abstract) Mazzo et al. discloses the caisson 10 is an elongated cylinder. (See Figure 1) Mazzo et al. discloses the preferred metal for inner core 14 is high strength steel or an

Art Unit: 1786

alloy thereof. (See Col 2, lines 55-57) Mazzo et al. discloses a plurality of bands or straps 16 can be provided, each of which being in spaced apart relationship to the others, welded around the periphery of core 14, in order to anchor the core 14 to its surrounding concrete 12. Bands or straps 16 are preferably steel. (See Col 2, lines 60-65) Examiner notes that the claim limitations do not require that the first material and the second material be different. Therefore, Mazzo et al. discloses a rod comprising an inner first material and an over-wrap of a second material structurally discontinuous relative to said inner rod.

Regarding claims 39, 57 and 78 Mazzo et al. further discloses alternatively, an outer metallic shell 18 can be disposed around concrete outer portion 12. Shell 18 can be used with caissons 10 with or without steel bands or rings 16 and may even be used to surround a portion of the caisson 10 only, as shown in FIG. 2. (See Col 2, lines 66-67) As such, examiner notes that the steel bands of the core as disclosed in Mazzo et al. would provide a textured surface. Outside a showing to the contrary, it is the examiner's position that the rod as disclosed by Mazzo would be fully capable of mechanically gripping a concrete matrix in which the rod is embedded.

Regarding claim 74, Mazzo et al. discloses the cross section of the steel core 14 can be any regular or irregular polygon or symmetrical or asymmetrical shape including, but not limited to, a triangle, a square, an ellipse, star, a rhombus, a parallelogram, a hexagon, etc. (See Col 3, lines 9-13)

Claim Rejections - 35 USC § 103

14. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:
- (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.
15. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:
1. Determining the scope and contents of the prior art.
 2. Ascertaining the differences between the prior art and the claims at issue.
 3. Resolving the level of ordinary skill in the pertinent art.
 4. Considering objective evidence present in the application indicating obviousness or nonobviousness.
16. Claims 9, 11, 25, and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Edwards et al. (US 2001/0023568) in view of Fields (US 2,416,518).

Regarding claim 9, 11, and 25 Edwards et al. discloses all of the claim limitations as set forth above. Edwards et al. discloses providing raised surface features on the bar creates mechanical interlocking with the concrete. (See [0044]) Edwards et al. also discloses a rebar having a core 203 and sheathing 202. (See [0047])

Fields discloses an apparatus for cutting spirals on the surface of rods and bars used for reinforcing concrete. (See Col 1, lines 7-13) Fields discloses there is formed on such a

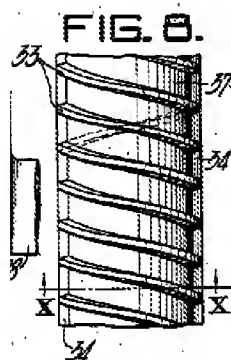
Art Unit: 1786

reinforcing bar by the rolls 29, a plurality of double spiral lugs 33 which are spaced equidistant apart throughout the length of the bar. It will be seen that there is also formed on the reinforcing bar 37, a pair of longitudinally extending ribs 34 which bisect the spiral grooves 36. (See Col 5, lines 47-52)

As Edwards and Fields are both directed to reinforcing bars, the art is analogous.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to utilize the cutting apparatus as taught by Fields in order to provide the zones of weakness on the bar as disclosed by Edwards, motivated by expected success of providing mechanical interlocking with a raised surface as discussed in Edwards.

Regarding claim 26, Fields discloses the reinforcing bar may be cut on the surface in a continuous helical pattern. (See Figure 8)



17. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were

Art Unit: 1786

made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Allowable Subject Matter

18. Claims 12-21, 28-37, 40-55, 58-73, 75, 77, 79-81 contains allowable subject matter.
19. Claims 12-21, 28-37, 40-55, 58-73, 77, 79-81 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.
20. The following is an examiner's statement of reasons for allowance: the prior art does not disclose, teach, or suggest a reinforcing rod as claimed by applicant. Specifically, the prior art does not teach
I, wherein said inner rod is a cylindrical rod having radius r_r and an ultimate tensile strength σ_{ur} , the frictional shear stress after bond failure between the inner rod and the over-wrap is τ_r , and said over-wrap is comprised of structurally discontinuous portions having a maximum length l_{so} , wherein

$$l_{so} = \frac{\sigma_{ur} r_r}{\tau_r}$$

as recited in claims 12, 28, 40, and 58. One of ordinary skill in the art would have no motivation to optimize the parameters of not only the rod but also the over-wrap in the

Art Unit: 1786

manner as claimed by applicant and shown above. As such, claims 13-21, 29-37, 41-55, 59-73 also contain allowable subject matter since they are dependent from the above named claims. Regarding claim 75, the prior art does not teach a method of inducing toughness in a structural element comprising embedding in said structural element a plurality of structurally or functionally discrete meso-rods. Regarding claim 77, the prior art does not teach or suggest a textured outer surface of a rod to enable mechanical grip to a concrete matrix additionally comprising portions thereof which are masked from contact with said concrete matrix. Edwards et al. teaches texturing the surface of a rod *or* providing a coating that does not adhere well to concrete. One of ordinary skill in the art would not have been motivated to combine the two embodiments or to limit the coating to only portions of the rod. As such, claims 79-81 also contain allowable subject matter since they are dependent from claim 77.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

21. Any inquiry concerning this communication or earlier communications from the examiner should be directed to ALTREV C. SYKES whose telephone number is

Art Unit: 1786

(571)270-3162. The examiner can normally be reached on Monday-Thursday, 8AM-5PM EST, alt Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Larry Tarazano can be reached on 571-272-1515. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/D. Lawrence Tarazano/
Supervisory Patent Examiner, Art Unit 1794

/ACS/
Examiner
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